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STATINTL

PROTOCOL

of the 3-d meeting of the USA - USSR Working Group
on Technological Methods of Preventing Air Pollution
from Industrial Enterprises

Moscow, June, 1975

ENVIRONMENT
Air Pollution-Industrial
Sources

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In accordance with the Memorandum of the 3-rd session of the joint US/USSR Working Group on cooperation in the field of protection of environment (USSR, Moscow, December 9 - 12, 1974) a meeting of the Working Group was held in Moscow during 6 - 13 June, 1975.

The U.S. group was headed by Mr. R.E.Harrington, Lirector, Air Pollution Control Division, EPA.

The USSR group was headed by Mr. J.A.Balashov, Chief, All Union Gazoochistka Combine, Ministry of Chemical and Petroleum Engineering.

A list of participants is attached as Appendix 1.

At the meeting results of the work since the second meeting of the working group were summed up.

The sides stated successfull development of cooperation in project areas, adopted at the second meeting of the working group.

Several teams participated in the meeting. They discussed specific projects in accordance with the Memorandum of the 3-rd session of the joint US/USSR Comission.

1-2. 1. Gaseous emission control.

1-2. 2. Particulate emission control.

1-2. 3. Improvements and modification of technological processes.

Summing up the results of cooperation during May 1974 - May 1975 both sides came to the conclusion that the personnel requirements, scope and character of joint efforts as well as their schedule will be determined for a series of topics, in category "B".

According to this, some topics of "B" category were transfered to category "A".

Because of their singleness of purpose topics B - 11 "Power plants with combined cycles using coal and petroleum gasification", B-12 "Gas cleaning systems for coal and petroleum gasification in energetic plants" and B-13 "Design and operation of industrial energetic systems using coal and petroleum gasification" were combined in one project A-9 "Complex methods of fuels (coal and petroleum) usage in energy generating systems with prevention of harmful emissions into the environment".

Topic B-7 "Improvement of coal floatation technology" will be designated as topic A-10 in the future.

By joint agreement topic B-4 "Control Ice Fog" is excluded from further consideration.

In accordance with the US side proposal, topic B-10 "Development of common procedures for comparison of economics of different processes on heavy petroleum raw material hydrodesulphurization" is excluded from the cooperation program.

Topic B-10 was partially included in topic A-7 "Preliminary recovery of metals in the course of residual oil raw materials desulphurization", which can be seen in the corrected cooperation program on topic A-7.

Topics B-11, B-12 and B-13 were separated from topic B-5 "Coal and petroleum gasification and cleaning of fuel gas for power plants", and in accordance with the Working Group decision these topics are united in the projects A-9. The title of topic B-5 was then changed to "Coal and petroleum gasification and cleaning of gas from harmful impurities, which pollute the atmosphere". The scope and objectives of cooperation on this topic were detailed. The scope and objectives of cooperation on topic B-6 "Production of liquid fuel from coal and petroleum mixtures" were also detailed.

The program of works on the planned projects for 1976 was considered and agreed. This program is described in Annex II.

Noting that there are several kinds of activity in the interests of the Stationary Source Air Pollution Control Technology Working Group (I) and the Joint Project Group on Testing and Operation of Air Pollution Reduction and Waste Disposal Systems for Thermal Power Plants (II), that are of common interest, a joint meeting was held (in conjunction with the annual meeting of the Stationary Source Air Pollution Control Technology Working Group) to examine coordination between specific projects. The Working Group on Design and Operation of Air Pollution Reduction and Waste Disposal

Systems for Thermal Power Plants, headed by Mr.Trubitsin and Mr. Falkenberry, was represented on the US side by Mr.Oglesby and Mr.Yeager, and on the Soviet side by L.Trubitsin and L.Kropp. The Stationary Source Air Pollution Control Technology Working Group was headed by Dr.Dalinchov and Mr.[illegible] ton.

Four activities were identified for coordination by the Working Groups. Because of the [illegible] and existing protocols of the two working groups, responsibility was assigned to each activity as indicated below:

Item	Activity	Responsibility
1.	Measures directed to reducing formation of nitrogen oxides in the combustion of solid, liquid and gaseous fuels	[illegible]
2.	Wet Scrubbers for collecting of Power Plant Fly ash	[illegible]
3.	Evaluation of High Efficiency Dust Collection Equipment in the US and USSR	[illegible]
4.	Cooperative Development of Instruments for Operating Problems of Electrostatic Precipitators	[illegible]

Each working group [illegible] working group coordinated activities [illegible] results of each activity. Those items [illegible] responsibility is assigned to the [illegible] ed below within the scope of this activity.

It was agreed that a particulate control technology symposium would be held in the Soviet Union under the lead of the Joint Project Group on Design and Operation of Air Pollution Reduction and Waste Disposal Systems for Thermal Power Plants. The Stationary Source Air Pollution Control Technology Working Group will assist as appropriate.

The Working Group considered the questions of cooperation between the specialists of both countries in the field of controlling air pollution in the cement industry. The sides agreed on preliminary topics of future cooperation (point B-14).

Agreement was reached on the question of information transmission according to the agreed [illegible] and on the visit of American specialists to the [illegible] for coordination of the working programs of cooperation.

The Working Group considered the proposal of the U.S. side about cooperation on control [illegible] in nonferrous metallurgy.

The Working Group confirmed that the [illegible] side will present specific proposals on these questions. The Soviet side will consider these proposals and will give its own proposals.

The U.S. side [illegible] cooperative program [illegible] of the [illegible] the total impact of all [illegible] of meetings signed on [illegible] agreed to investigate further the possibilities for cooperative undertakings in this area.

Both sides agreed that visits in 1975 will be carried out in accordance with the Memorandum of the 3-rd meeting of the Joint American-Soviet Committee on cooperation in the field of protection of environment, which was held on 9-12 December, 1974.

The number of specialists and schedule of visits in 1976 will be considered and agreed at the meetings of specialists on separate projects in 1975. This will also be reviewed and confirmed by the coordination centres of the Joint American-Soviet Committee.

Both sides will contribute to contacts between industrial enterprises of both countries related to the [illegible] of negotiations on the questions of interest.

Chairmen of the Working Groups will exchange the [illegible] on this question in the course of the III quarter, 1975.

Both sides agreed, that the correspondence on the questions, concerning separate projects must be [illegible] project leaders and copies should be sent to the heads of Working Groups of both countries. However concerning the questions, concerning the Working Group will occur between the Chairmen of the Working Group of both countries.

Changes and additions to the protocol can be made by the agreement of the Chairmen of the Working Groups [illegible] coordination centres of the Joint American-Soviet Committee.

American specialists visited the Scientific Central Design Institute ([illegible], Volgograd).

In accordance with the order of conducting the meetings of the Working Groups, the Forth Meeting of the Working Group will be held in the 2-nd quarter, 1976, in USA.

Both sides noted the meeting of the Working Group was conducted in a spirit of friendship, united understanding and cooperation.

The Protocol was signed on June 12, 1975 in Moscow, it is in English and in Russian, two copies each, both languages equally authentic.

R.E.HARRINGTON,
Head of the US Working Group,
Director, Air Pollution
Control Division, EPA

U.A.BALASHOV,
Head of the Soviet Working
Group, Chief, All Union
Gazoochistka Combine

APPENDIX I

Delegates and experts - participants of the 3-rd Meeting of the US - USSR Joint Working Group on Technological Methods of Prevention of Air Pollution from stationary Sources

USA

MR. R.E. HARRINGTON	- Director, Air Pollution Control Division, EPA
Mr. KELLY JANES	- Chief, Fuel Processing Section, EPA
Mr. P.W. SPAITE	- Consultant, Licensed Attorney, Engineer
MR. PHILIP S.LOWELL	- Vice-President, Radian Corporation
MR. SABERT OGLESBY,Jr.	- Vice-President, Southern Research Institute
Mr. KURT E.YEAGER	- Program Manager, Electric Power Research Institute
M.S. M.STASIKOWSKI	- Technical Assistant, Air Pollution Control Division, EPA

USSR

Mr. J.A.BALASHOV	- Chief, All Union Gazoochistka Combine
Mr.L.A.TRUBITSIN	- Chief, Main Technical Administration, Ministry of Energy and Electrification

Mr. V.G.GUSAROV	- Representative of the State Committee on Science and Technology
Mr. B.F.PODOSHEVNIKOV	- Director of NIIOGAZ
Mr. I.K.RESHIDOV	- Director of GIPROGAZOOCHOSTKA
Mr. V.I.LAZAREV	- Deputy Director of NIIOGAZ
Mr. G.K.LEBEDJUK	- Deputy Director of NIIOGAZ
Mr. V.M.MASLENNIKOV	- Chief of laboratory IVT, Academy of Sciences
Mr. G.V.ASTAFIEV	- Deputy Chief Engineer VNIINP
Mr. N.S.EGOROV	- Deputy Director of NOOTT, Ministry of Coal Production
Mr. J.V.ERJOMIN	- Deputy Director of IGI, Ministry of Coal Production
Mr. A.P.EGORYCHEV	- Chief Engineer of GLAVENERGO, Ministry of Ferrows Metal Industry
Mr. G.I.VODOLAZKY	- Director of NIPICSTROM, Ministry of Civil Engineering
Mr. V.M.ARASHKEVICH	- Representative of GLAVENERGO, Ministry of Ferrous Metal Industry

Experts

Mrs. N.V.FILIPPOVA	- Chief Engineer of GLAVGAZOOCHISTKA
Mr. Ju.S.MILOVIDOV	- Coordination department Chief
Mr. B.L.EFIMOV	- International Relations sector Chief
Mrs. L.E.SCHUMAROVA	- Group Head
Mr. A.V.GLADKY	- Master of Technical Sciences, Laboratory Chief

Mr. I I.CHERNENKOV	- Laboratory Chief, IGI
Mr. V.V.MANSHIN	- Laboratory Chief, VNIINP
Mr. M.F.BERNART'EVSKER	- Senior Research Worker of VNIINP
Mr. P.A.SOLOVYEV	- Scientific-research group of IGI, Academy of Sciences
Mr. J.A.VISKUNENKO	- Senior Research Worker of IGI, Academy of Sciences
Mr. B.N.MAXIMOV	- Chief Engineer of Glavenergo, Ministry of Ferrous Metals, USSR
Mrs. M.N.BERESINA	- Group Chief of NCMT, Coal Ministry

Interpreters :

Utkin N.Ja.

Zaletayev G.S.

Bunimovich I.A.

Appendix II.

A-1. Development of Lime/Limestone Scrubbing for Stack Gas Desulfurization

A-2. Stack Gas Desulfurization using Magnesia-Slurry Scrubbing

A-3. Stack Gas Desulfurization by Ammonia Scrubbing

Backgrounds

The Working Group considers the work of the sub-group successful. Because the cooperation in proceeding well, only those tasks not delivered on schedule are noted in this protocol.

A-1. Development of Lime/Limestone Scrubbing for Stack Gas Desulfurization.

Task 3 - USSR, report on the Magnitogorsk plant

Task 4 - USSR, arrangement of Magnitogorsk plant visit by US specialists

Task 5 - US, Widows Creek Equipment description

A-2. Stack Gas Desulfurization using Magnesia-Slurry Scrubbing

Task 1 - USSR, report on MgO process consideration

Task 2 - US, Boston Edison Report - USSR, Ryazan design data

A-3. Stack Gas Desulfurization by Ammonia Scrubbing.

All tasks are on schedule.

Two Protocols have been signed by the Gaseous Emissions Abatement (also call sulfur oxide) Sub-Group. The first was signed on 16 August 1974 at Research Triangle Park and the second on 21 November 1974 in Moscow.

Task 1.

The Working Group requests the sub-group to develop detailed plans for 1976 in their meeting in September 1975 in the USSR. It is anticipated that the sub-group will meet twice in 1976, once in the second quarter in the US and again in the fourth quarter in the USSR.

Task 2.

The Working Group approves the principle of the sub-group request in the 21 November 1974 protocol for the exchange of technical personnel at Shawnee, Severo-Donetsk, Magnitogorsk, or possibly other onstallations.

Task 3.

The Soviet side requests the American side to investigate the potential for including the following tasks in the cooperation: (1) USSR specialists to study the MgO process at an oil fired thermal electric power station in the US. This would be done after the completion of the present sub-group cooperative laboratory effort. The studies at the US power station would incorporate improvements found in the present laboratory effort.

(2) An investigation of the [illegible] process to be used at the Colbert pilot plant by both US and USSR specialists. Trips to the test plan would be made by both US and USSR. This would be followed by a similar program at the Ryan Hydro-electric Power Station.

(3) A study of the limestone process to be performed at pilot plants at Shawnee and Severo-Donetsk. The improvements developed in laboratories and at pilot plants of both countries to be used during the study.

The test program to be developed by the specialists of both countries.

If the sub-group works out a mutually satisfactory program before the next meeting of the working group they may seek approval of the working group chairmen.

A -- 4. Development of Methodology and Establishment of Efficiency of Industrial Dust Collection Equipment for Fine Particulate.

The state of the problem

Information exchange has occured and efforts on preparation have been made for testing efficiency of gas cleaning equipment as installation in the USSR (Novodynskaya G.R.E.S. and Zaporozhye ferroalloy plant) and in the USA ("Allen" power station and wet scrubbing systems Lone Star Steel Company).

With the purpose a meeting of US and USSR specialists was held in the USSR and test program and test techniques were agreed. During the III and IV quarters tests will be conducted. In the IV quarter 1975 test results will be discussed in the U.S.

The sides agreed to expand the project to perform tests of precipitators (99% or higher efficiency) after successful completion of the work in 1975.

Objective

Determination of optimal conditions for application of electrostatic precipitators on thermal power stations.

Scope of work

Task I.

For conduct of further cooperative tests of precipitators at thermal power stations in accordance with the objective, the sides agreed to exchange information on characteristics of different types of coal (and ash) used at power stations in the USSR and USA and also will agree as to types of coal to be burned in the plants being tested.

(c) of the Act are applicable, shall maintain such records of production and related factors, effluent flows, and pollutant amounts or concentrations as are necessary to demonstrate his compliance with the pretreatment standard established for the industrial category which includes that source. All such records shall be made available to officials of the Environmental Protection Agency upon demand. A summary of such data indicating the discharger's compliance with pretreatment standards shall be prepared within 9 months of the promulgation of specific pretreatment standards applicable to that subcategory and every 9 months and submitted to the EPA Regional Administrator. The Regional Administrator may deem this submission requirement fulfilled if he determines that adequate records are being maintained by State or local authorities.

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Task 2.

After exchange and processing of information on characteristics of coal (ashes) and agreement by both sides on coal types in the USSR and USA both sides will supply information on power stations using the different types of coal. Tests will be conducted independantly by both countries in accordance with the program and technique adopted at the meeting of Soviet and American specialists of the working subgroup on removal of fine suspended particles (April 14-24, 1975, Moscow).

The list of test installations and schedule will be agreed after information exchange on characteristics of coal and information on test sites. Test site information will include type of boiler, and type of control equipment.

Task 3.

After competion of the tests according to the schedule in Task 2 both sides will exchange reports on their results.

Task 4.

For discussion of the results obtained, a meeting of USSR and US specialists will be held in the USA.

Schedule

Task 1 - October, 1975

Task 2 - December, 1975

Task 3 - two month after completing of the testing

Task 4 - IV quarter, 1976

A - 5 Study of Electrostatic Precipitators

The State of the Problem

On the basis of previously adopted resolutions both sides exchanged complete onformation. Preparatory work was conducted to take part on the joint improvement of an American mathematical model for electrostatic precipitator performance.

Soviet specialist will meet with American experts to complete the joint work in the U.S. in July 1975.

Assuming success on the given project the sides agreed to continue cooperation on following topics of project A-5:

1. Joint development of improved methods of modelling gas streams as applied to precipitator installations.
2. Conditioning gases before precipitators.
3. Study of physical mechanisms of reentrainment in precipitators and associated systems of electrode rapping.
4. Study aimed to increasing reliability of electrostatic precipitators and their components.

Objective

Increasing the efficiency and reliability of precipitators.

Scope of Work

Task 1

The sides will exchange information in a form of reports on each topic, which must include :

a) a list of organizations which develop the themes mentioned above and works conducted earlier, being conducted at the

b) brief description of the essence of on-going work.

The sides will provide available additional information on the sections for which information exchange has already been completed.

Task 2.

After studying the information available from the first task both sides will attempt to resolve possible question with written correspondence.

Task 3.

After completion of task 2 the side will meet in the USSR to discuss and develop working programs and procedures of joint investigations.

Schedule

Task 1 - February, 1975

Task 2 - May, 1976

Task 3 - II quarter, 1976

A - 7. Preliminary Recovery of Metals During Residual Oil Desulfurization for Production of Low Sulphur and Low Ash Boiler Fuel

The state of the problem

Both sides exchanged procedures for testing demetalization catalysts and also analytical and physico-chemical methods of evaluation of usable catalysts and properties of initial raw materials and products. The concrete program is agreed for the testing of USSR and USA demetalization catalysts on specific raw materials representative of each country as well as operating conditions, duration of tests and number of analytical investigations on products obtained.

In the 1-st half of 1975 both sides started to fulfil the planned program. The Soviet side recieved the necessary amount of raw materials and catalyst from the USA and began to conduct testing in accordance with the program. Two types of residual raw material and demetalyzation catalyst were sent to the USA to conduct the planned investigations. In the 2-nd half of 1975 testing of catalyst samples will be over and efficiency will be determine. Results of the investigations will be considered by US and USSR specialists and a joint report will be developed and materials for general publications in the USA and USSR will be prepared.

In connection with delay of supply of raw material and catalyst comletion of works in accordance with project A-7 will be shifted to the beginning of 1976.

Objective

Development of a process of preliminary metal recovery during residual oil desulphurization for production low sulphur and low ash boiler fuels.

Scope of works

Task 1.

US and USSR specialists will discuss results of testing raw material and a catalyst by the Soviet side, received from the USA and preliminary result of testing soviet raw material and a catalyst, conducted in the USA.

At the same time specialists of both sides will use procedures, agreed upon earlier in accordance with the Protocol of the 2-nd Meeting of the Clean Fuel Subgroup signed on December 13, 1974 and will discuss new areas of works on project A-7, of mutual interest. For this purpose USSR specialists will visit the USA.

Task 2.

Completion of testing soviet raw material and catalyst in the USA, joint discussion of a preliminary report and preparation of materials for publication in the USA and USSR.

The proposed project on new works within program A-7 will be discussed. With this purpose US specialists will visit the USSR.

Task 3.

Adoption of the program of new joint works within project A-7 and specification of procedures of conducting experimental works. With this purpose USSR specialists will visit the USA.

Task 4.

Conduction by both sides of experimental investigations, discussion of obtained results, summation and development of a joint report.

Cost estimation of procedures of demetallization and hydrosulphurization. Exchange of procedures on cost estimation.

For accomplish of task 4 US and USSR specialists will visit the USSR and USA.

Schedule

Task 1 - III quarter, 1975

Task 2 - I quarter, 1976

Task 3 - II quarter, 1976

Task 4 - III-IV quarter, 1976.

A -8. Dry Quenching of Coke

The US side informed the USSR of the high level of interest by both the US government and industry in demonstrating the dry coke quenching process in the United States and that progress in evaluating the US interest would be accelerated by early receipt of samples requested in the Protocol of December 20, 1974.

The Soviet side agreed to assist as possible in providing these samples, and to provide the samples called for in the above protocol by 15 September, 1975.

A - 9. Complex Methods for Fuel Application (Coal and Oil) to Energy Generating Systems for the Elimination of Harmful Emissions to the Environment

In additional exchange of information and meetings of experts on the processes of fuel gasification and methods of energy generation took place during the period from May 1974 to May 1975 in the USSR (11 - 25 October, 1974) and the USA (December 1 - 13, 1974).

As a result, the scope of joint works and the schedule on the three topics have been formulated (Protocol of December 13, 1974, Washington), namely :

B-11 "Combined-cycle power stations with gasification of coal and oil"

B-12 "Gas cleaning systems for coal and oil gasification in power generation systems"

B-13 "Design and operation of commercial coal and oil gasification in power generation systems"

Having exchanged views both sides have arrived at the conclusion that the above-said topics would preferably be combined into a single project taking into account their general direction and for convenience of coordination of the works to be completed.

In view of the fact that the scope of the cooperative works, persons involved, and the interaction of their efforts in these topics have been defined, both sides have agreed to transfer them to the "A" category (designating) the project as A-9

"Complex methods for fuel application (coal and oil) to energy generating systems for the e... ination of harmful emissions to the environments".

The topics B-11, B-12, B-13 included in the project A- 9 will further be referred to as "a", "b", "c".

The schedule of these topics is somewhat changed as proposed by the US side.

(a) Power generation plant with combined cycle based on gasification of coal and oil.

1. Background

Oil and coal combined-cycle power generation systems are of interest to both the US and the USSR. The purification of the products of gasification and combustion is of major importance to both long-term operation of the power generation system and for environmental protection.

2. Objective

It is the objective of this effort to jointly select the best integrated gasification, clean up and combined-cycle power plant system and to prepare preliminary designs of these selected combinations which would form the basis for additional effort that could result in the design of a full scale plant.

3. Scope of Work

Task I

Information will be exchanged that would present the best power generation with combined cycle concepts in both countries. This information should be concise and conceptual

in technical details and will include the following:

— Cycle configurations, coal/oil gasification, fuel gas clean up and power generation consisting of flow diagrams, operating parameters and material balances. Configurations will be identified as either base, intermediate or peak loading type operations.

— The basis and philosophy behind the design selection will be discussed.

— Cost of the electrical and thermal energy will be presented and consideration will be given to, effects of variations in configuration and in plant capacity on the cost. Since the technology being presented is conceptual and preliminary in nature the cost comparison should be made by indicating effects by percentage decrease or increase in the cost of electrical and thermal energy instead of absolute values.

— To provide for a basis of comparison both sides will present a cost analysis of a conventional coal/oil fired power plant. This plant should include emission control and consist of five (5), 500 megawatts steam power units (540°C, 150 atm).

— A concise state-of-art of the integrated combined cycle power generation technology in both countries will be prepared. Included will be a list of all combined cycle installations.

Task II.

One month after the exchange of information described in Task I has been completed, a meeting will be held to discuss the exchanged information. The proceeding discussions and results of this meeting will be presented in a report jointly prepared by both sides and will be published in both countries.

Task III.

Based on the results, information and program defined in Task II, on the best conceptual designs of an integrated oil and coal gasification, clean up and combined cycle power plants, both sides will conduct engineering studies of the selected 1 or 2 configurations by each side. The studies would address the technology, economics and operating conditions to a level that would be a basis for an engineering design of a commercial operations. The results of these studies will be exchanged by both sides.

Task IV.

One month after the exchanged material has been received, both sides will meet in the USSR to discuss and review the information. The results of the engineering evaluation (Task IV) will be used to identify the best one or two designs for a commercial integrated coal and oil gasification, clean up and combined cycle power plant. During this meeting, further cooperative effort and programs will be determined. The results of this meeting will be jointly written summarizing the results and recommendations of the group and would include the results from Task 1 through Task IV.

Task V.

Both sides will conduct work to optimize the systems selected.

The results of the parametric studies will be used to identify the best one or two conceptual designs for integrated oil gasification, clean up and combined-cycle power plants and the best one or two conceptual designs for integrated coal gasification, clean up and combined cycle plants which would be used as the study basis for future cooperation.

The results of this work will be discussed at the meeting of the experts in the USA.

Task VI.

The report will define future work which would fulfil the intent of this project which is to result in the best design of a commercial plant.

A visit of the US expert to the USSR is provided to develop the report.

4. Timetable

Task I - August 1, 1975

Task II - September, 1975

Task III - IV quarter, 1975

Task IV - I quarter, 1976

Task V - June, 1976

Task VI - II half year, 1976

(b) Gas Cleaning Systems for Coal and Oil Gasification Systems

Gas Cleaning Systems for the Coal and the Oil Gasification

1. Background

Both the US and the USSR are developing gas cleaning - desulphurization and particle removal systems adapted for use in fuel gasification for power generation plants. These systems produce a clean gaseous fuel either for a steam boiler or for a gas turbine combustor. Various processes produce the fuel gas at temperatures from 500°C (900°F) to 1500°C (2700°F) and at pressures from 1 atm to 30 atm. Similarly, various gas cleaning processes operate at temperatures from 60°C (150°F) to 1000°C (1800°F) and at pressures from 1 atm to 30 atm. If a low temperature cleaning system is employed, a means for cooling the fuel gas is required ; means for recovering its thermal energy may also be required. Practical low temperature gas cleaning systems are based on scrubbing with aqueous solutions. High temperature desulphurization based on solid sorbents - limestone/dolimite, iron oxide, manganese oxide, etc. - and deparicularization based on cyclones and granular filters have been studied in both the US and the USSR.

2. Objectives

The objective of the work is to identify the most promising gas cleaning systems for fuel gasification power generation plants and to recommend a program which will complete the development and first full scale operation of such systems.

3. Scope of Work

Task 1

Data to be used in the work will be assembled by responsible organizations in the US and the USSR. Information

exchanged describing the systems -- flow diagrams, operating conditions, material and energy balances, performance, and the state of development. The advantages and disadvantages of each system will be discussed. Data would also address the relative economics of each concept.

Task II.

One month after exchanged material has been received, a meeting will be held to discuss the exchanged material. All material must be received from both sides one month prior to the meeting.

Task III.

Selection of preferred or best gas cleaning system - one for operation at low temperatures and one for operation at high temperature will be made by the US and by the USSR. These selections will be made based on estimates of performance and economics. The data and methods for evaluating the systems will be shared, unless previously established proprietary rights prevent such sharing. Both the technology and philosophy of the evaluation process will be discussed.

The results of this work will be summarized during the meeting of the experts in the USSR.

Task IV.

The results of the work will be presented in a joint final report. This document will not only summarize work accomplished results achieved, and conclusions, reached, it will recommend further studies, laboratory work, pilot plant investigations and demonstration efforts to acieve successful cleaning systems for fuel gas in coal-fired power plants.

At the meetings, based on the best high and low temperature cleaning systems as chosen by each side, the technology, engineering design, economics, measurement technique and status of work will be discussed. Based on the discussions, recommendations will be made as to further project work.

Task V.

The plan and major contents of the joint report will be developed and a schedule of mutual exchange of materials for the report will be determined during the meeting of the experts in the USA.

Task VI.

The final editing and arrangement of the report presented will be made at the working meeting in the USSR.

4. Schedule

Task I - August I, 1975

Task II - September, 1975

Task III - IV quarter, 1975

Task IV - I quarter, 1976

Task V - June, 1976

Task VI - II half year, 1976

(c) Design and Operation of Commercial Coal or Oil Gasification or Power Systems

1. Background

At the present time application of coal and oil gasification for power generation plants are being considered by investigators in the US and USSR. These plants are now being designed without the aid of mutual cooperation by both countries. Review by the other country of the various design stages (preliminary, engineering, and detailed design), plant operation, and data evaluation will permit mutual assistance to achieve best possible operation of utility gasification combined cycle plants to the benefit of both the US and USSR. Common problems can be identified and recommendations given for their solution.

2. Objective

To identify specific programs where mutual collaboration in demonstration projects is desirable.

3. Scope of Work

Task I - Both sides will review demonstration work in their respective countries and identify candidate projects for inclusion in the recommended program. The candidate sites will be identified as to their size, location, economics, configuration and stage of development.

Task II - A meeting betweem experts will be held to consider candidate processes and select in each country those which will be included to be studied in the project. At the meeting, a program will be finalized to identify data to be exchanged, schedule for plant visits and future pro-

will be completed prior to Task III.

Task III - Review of preliminary, engineering and detail, design, by the other countries' experts, of plants which are selected for the program, would follow approval of the project. This review would make suggestions as to: A) possible modification to be made before or during construction and B) identification of possible problem areas that should be closely observed by the operators.

The results of this work will be summarazed during the meeting of the experts in the USSR.

Task IV - Skilled observers will be sent to the operating plants to observe them in operation and to make comments to the operating country concerning possible improvements in operation.

Task V - The operating data will be received, annalyzed and suggestions with regard to operation will be made. Such suggestions can be in the form of recommendations for modification of operation, modification, of plant configuration or for improvement in design of future plants.

The joint report on the results of the cooperation by points 1 - 5 will be presented at the working meeting in the USSR.

Schedule

Task I - August I, 1975

Task II - September, 1975

Plant visits -

in the USA - September, 1975
in the USSR - I quarter, 1976

Task III - June, 1976

Task V - II half, 1976

A - 10. Development of Floatation Desulphurization Technology

1. Background

In the USSR and the USA floatation is widely used for preparation of coal fines.

However flow sheets, equipment, regeneration conditions, floatation quality parameters are somewhat different in both countries.

One of the most difficult problem is separation of pyritic sulphur from coal by means of floatation.

In both countries, the investigations in this field have been conducted in different directions.

Cooperation of the USA and USSR spedialists for solving the coal desulphurization problem is of great practical importance for both countries as related to environmental protection.

At this meeting, discussions were held on the fulfilment of the scheduled work for 1974 and the 1-st quarter 1975 on development of floatation desulphurization technology and suggestions of both countries on the planned project for 1976.

It is noted that obligations on the program for 1974 and 1-st quarter of 1975 were fulfilled by both sides as scheduled.

It is planned in 1975 to exchange coal samples and floatation reagents; and both countries will conduct tests on coal floatation for desulphurization.

Task III.

Specialists of both countries will meet to develop working procedures of joint investigations on coal desulphurization by form floatation.

Task IV.

Coal samples and floatation reagents exchange.

Task V.

Evaluation of coal samples, by mutually agreed upon procedures :

a) chemical composition ;

b) mineral-petrographic composition ;

c) granulometric composition ;

d) fractional composition.

Task VI.

Specialists' meeting of both countries in the USA to evaluate quality of samples presented and to specify the procedures for conducting experiments on coal floatation desulphurization.

Task VII.

Investigations of floatage of coal samples, by mutually agreed upon procedures :

a) study of the characteristics of floatation reagents, by mutually agreed upon procedures;

b) development of optimal reagent conditions for coal floatation desulphurization.

Task VIII.

Specialists' meeting of both countries in the USSR to discuss results of investigations and to develop the programs of future works.

4. Schedule

Task I - July, 1975

Task II - III quarter, 1975, USSR

Task III- IV quarter, 1975, USA

Task IV - I quarter, 1976

Task V - II quarter, 1976

Task VI - III quarter, 1976

Task VII- IV quarter, 1976

Task VIII- IV quarter, 1976

B - 1 Study, Aimed to Development of Scrubbers Using Condensation Effect

B - 2 Study of Fibrous Devices for Mist Elimination as Applied to Three Stage System

B - 3 Study on Application of Cloth Filters

Both sides agreed to delay consideration of work on this problems (B-1; B-2; B-3) for late date.

B - 4 Study of Control Methods for Ice Mist

Both sides agreed that the joint work on project B-4 will not be conducted and this question is excluded from further consideration.

B - 5 Coal and Petroleum Gasification and Gas Purification from Harmful Impurities to Avoid Polluted Atmosphere

Status of the problem

At the meeting results of fulfilment of works for 1974 and the 1-st quarter 1975 and proposals by both sides on the project for 1976 were discussed.

It was noted that the gasification process is a great specific area independant from use of the gas produced. It was noted a great interest of both sides concerning cooperation in the field of coal and petroleum gasification.

Objective

Selection and development of the most promising gasification processes.

Scope of works

To achieve the above purpose it is necessary to complete

the following tasks in 1976 :

Task 1. Both sides will exchange additional information on the state of developments in the field of coal and petroleum gasification.

Task 2. Familiarization of USSR specialists with experimental plants in the USA.

Task 3. Familiarization of US specialists with experimental plants in the USSR.

Task 4. The sides will exchange opinions on the cooperative program and on development of program projects.

Schedule

Task 1 - March, 1976

Task 2 - May, 1976

Task 3 - September, 1976

Task 4 - December, 1976

B - 6. Production of Liquid Fuels from Coal and Mixture of Coal and Petroleum

The state of the problem

At the meeting results of fulfilment of works for 1974 and the 1-st quarter 1975 and proposals of both sides on the project of planned works for 1976 were discussed. It was noted that both sides are actively working to produce liquid fuels from coal and mixture of coal and petroleum.

Joint investigations in this field will contribute more rapid solution of the problem. It is reasonable to conduct these investigations in accordance with the joint programme.

Objective

Selection and development of the most effective processes of production of liquid fuels from coal and mixture of coal and petroleum.

Scope of works

To achive the above purpose it is necessary in 1976 to solve the following tasks :

Task 1. The sides will exchange additional information concerning the state of developments in the field of production of liquid fuels from coal and mixture of coal and petroleum.

Task 2. Familiarization of US specialists with experimental plants in the USSR.

Task 3. Familiarization of USSR specialists with experimental plants in the USA.

Task 4. Both side will exchange opinions concerning development of the program of joint works and development of the program project.

Schedule

Task 1 - March, 1976

Task 2 - May, 1976

Task 3 - September, 1976

Task 4 - December, 1976

B - 9 Elimination or Reduction of Harmful Emissions in Stack Gases of Ferrous Metallurgical Plant

At the present time this theme is being accomplished.

Five themes are proposed for 1976 including study and development of technological processes to prevent air pollution from waste gases in the following operations:

- agglomeration ;
- coke-and-chemical ;
- blast furnace ;
- steel making ;
- metal rolling.

An object of this work is to collect data and information on processes for elimination or reduction of harmful emissions in stack gases used in the USA and USSR, which could be employed in the metallurgical industry of both countries.

Scope of work

This objective can be attained by accomplishing the following tasks.

Task 1.

The scope and schedule for exchange of information on the technology and design of appli. methods for the collection and cleaning of dust and gaseous emissions will be

decided during the meeting of Iron and Steel Task Force in 1975.

Task 2.

The Soviet experts will visit the US industrial plants and research institutions to study the methods of gas collection and cleaning of various ferrous metallurgy processes.

Task 3.

The US experts will visit the Soviet establishments to study the installations for dust and gas elimination in various ferrous metallurgy processes.

Schedule

Task 1 - 1975

Task 2 - tentatively III quarter, 1976

Task 3 - tentatively III quarter, 1976

B - 10 Development of a Common Method for Cost Comparison of Different Processes of Residual Oil Hydrodesulphurization

Both sides agreed to exclude this project from further consideration.

B - 14 Prevention of Air Pollution in Cement Industry

The Working Group consided the question of cooperation in the field of flue gas control in cement industry. Preliminary topics of further cooperation are agreed :

1. Design and construction of dust collection systems for new cement plants. Design standards of dust collection systems (experience exchange in designing).

2. New methods and means of dust collection and research works in this field (joint scientific and technical developments).

Information on dust control from technological processes and on protection of environmental atmosphere at cement plants in the USSR will be delivered to the American side in August 1975. The American side will transmit to the Soviet side information on dust control at cement plants in the USA in August, 1975.

On request of the American side the Soviet side will receive on equivalent conditions US specialists in September - October 1975 to coordinate working programs and familiarize themselves with dust control problem at cement plants in the USSR.

The Program of US specialists' visit in the USSR with which project Mr. Harrington is familiarized, will be sent to the American side after final agreement.

The American side agreed to receive in the USA delegation of Soviet specialists in the field of dust control at cement plants in the 4-st quarter, 1975 - I quarter, 1976.

B - 15 The Problem of Protection of the Atmospheric Air from the Emissions of Non-Ferrous Metallurgical Plants

American side expressed interest in cooperation in the area of air pollution control from non-ferrous metals industry.

Both sides have recognized the importance of cooperation in the field of protection of the atmosphere by harmful emissions from non-ferrous metallurgical plants.

The US side will submit to the USSR side their proposals for cooperation in the area of air pollution control from nonferrous metal industry. The USSR will submit their proposals within three months after receiving the copy of the proposals from the US.

TRIP REPORT OF THE STATIONARY SOURCE AIR POLLUTION CONTROL GROUP, GASEOUS EMISSIONS AND FERROUS METALLURGY SUB-GROUPS, TO THE USSR 11-22 NOVEMBER 1974

24 February 1975

Environment - Air Pollution

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STATINTL

20 MAR 1975

ABSTRACT

This report summarizes the visit of a US delegation to the USSR during the period 11-22 November 1975. The two teams, Gaseous Emissions and Ferrous Metallurgy, of the Stationary Source Air Pollution Control Group signed protocols.

The report gives some background, the status of USSR technology in these areas and the cooperative programs that have been or are being developed.

Approved For Release 2000/09/06 : CIA-RDP79-00798A000800040002-4

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1.0 BACKGROUND

Two teams of US delegates participated in discussions in the USSR with engineers and scientists of the USSR during the period 11-22 November 1974. The teams represented Gaseous Emissions and Ferrous Metallurgy Subgroups of the Stationary Source Air Pollution Control Technology Working Group.

This meeting had been set up during the 13-26 April 1974 Soviet visit to the US. The two objectives of the present US visit were (1) continue to develop and implement those programs begun previously and (2) identify new areas of cooperation.

The US delegation and their organizational affiliation is shown below.

Richard E. Harrington, EPA - Head of the Delegation

Margaret Stasikowski, EPA - Technical Assistant for the Delegation

Gaseous Emissions Team

Michael A. Maxwell, EPA - Head of the Team
William H. Elder, TVA - Member
Philip S. Lowell, Radian Corporation - Member
George R. Koehler, Chemico - Member
Robert W. Crozier, National Research Council - Member

Ferrous Metallurgy Team

Norman Plaks, EPA - Head of the Team
Robert C. McCrillis, EPA - Member
Herman C. Henschen, Bethlehem Steel Corporation - Member

All of the USSR delegates and participants are listed in the first appendix to each protocol, i.e., Sections 5.1 and 5.2, pages 18 and 41.

2.0 OBSERVED STATUS OF USSR CONTROL TECHNOLOGY

2.1 Gaseous Emissions

2.1.1 General

The average level of effort and technology in sulfur oxide control in the USSR is considerably below that in the US. The laboratories are rather austere. Funding of much of the work is from the Power Ministry. Their electric power producers, as in this country, will be unwilling users of the results.

Much of the Soviet effort in SO_2 control centers around the development and demonstration of a standard unit design. An electric power generating complex at Ryazan, outside Moscow, will be a prototype test site. Here two wet scrubbing systems, magnesium oxide and ammonia, will be built and tested. The USSR has one pilot test facility (20,000 scfm) at Severo-Donetsk for testing SO_2 removal processes.

There are a few areas where the Soviets are equal to or ahead of us. Cooperative programs could be fruitful here.

2.1.2 Limestone Scrubbing for SO_2 Control

The USSR has stated that lime or limestone wet scrubbing is of limited interest to the USSR. They have, however, operated a large 1,200,000 scfm (2,400,000 nm^3/hr) scrubber at the Magnetogorsk Metallurgical Complex for several years. The scrubbing system uses 21 scrubbers; three trains of seven scrubbers each. Wash water was used freely on the ceramic lined walls to prevent scaling. A titanium stack liner prevents corrosion. Limestone utilization is poor being only 45-50%.

Sulfur dioxide removal is about 80%. The operation is not typical of the normal applications in the US; nevertheless, it works.

There is a certain amount of bench-scale and theoretical work in lime/limestone at NIIOGAZ in Moscow. Despite their stated lack of interest, they are doing quite a bit of basic work. They do intend to do lime/limestone pilot studies at the Severo-Donetsk pilot in mid- to late 1975. The Soviets intend that the Severo-Donetsk work will primarily be contactor studies.

2.1.3 Magnesium Oxide Scrubbing for SO_2 Control

The focal point of the efforts in the MgO area is a prototype unit for the Ryazan power complex. The process development responsibility is fragmented. NIIOGAZ of the Chemical Ministry is responsible for the scrubber. Data on regeneration by fluid bed calcining is being developed within the Mineral Fertilizers and Agricultural Poisons Ministry. Precipitation and settling data were done by Professor Nivelt of Czechoslovakia. GIPROGAZOOCHISTKA of the Ministry of Chemical and Petroleum Machine Building has overall project responsibility while the Power Ministry is funding the project.

Soviet facilities at Magnetogorsk were operated several years ago to obtain data on $MgSO_3$ calcining. The Magnetogorsk limestone scrubbing unit was originally designed as a MgO system.

The only continuing experimental work is at Severo-Donetsk. Here a 20,000 scfm (40,000 nm^3/hr) pilot plant is operated continuously. The primary objective at Severo-Donetsk is evaluation of vapor-liquid contacting devices.

Four high velocity (5-8 m/sec) scrubbers have been tested. They are presently making optimization runs to select the best scrubber.

The Soviets have encountered difficulties with magnesium sulfite trihydrate formation for oil-fired application. This is similar to US experiences. They use a polyacrylamide flocculant to produce a 50 wt % thickened solid. Their circulating slurry contains 30 g/ltr $MgSO_3$ and 200 g/ltr $MgSO_4$. Sulfur dioxide removals are typically 90-95%.

The pilot plant is complete with respect to sorption and production of a $MgSO_3$ intermediate product. The $MgSO_3$ is discarded rather than regenerated which means the pilot plant uses only virgin MgO.

2.1.4 Ammonia Scrubbing for SO_2 Control

Present USSR plans call for a 500,000 scfm (1,000,000 nm^3/hr) prototype ammonia scrubber at the Ryazan power complex. The design is being done by GIPROGAZOOCHISTKA. The data upon which this design is being based were obtained from a system installed on a Moscow power station. The Moscow power station SO_2 control unit was dissembled eight years ago when the station switched from coal to gas. Some small amount of work in regeneration of sulfates is contemplated. The USSR feels they have sufficient data for their design.

This feeling was not shared by the US delegation on the basis of the USSR data and preliminary design presented.

2.2 Ferrous Metallurgy

2.2.1 General

The level of technology of steel making is on the whole about equal to that in the US. There are several areas such as energy recovery in which they are more advanced, whereas in pollution control there are several areas such as particulate control where they are behind us.

2.2.2 Sintering

The USSR is at the research stage in their program to develop gas recycle. Their first objective from gas recycle is to reduce the CO content of the exhaust gases; their second objective is reducing fuel requirements by recovering some of the heat. They anticipate a higher bed temperature which is expected to result in an improved sinter. They run lower basicities than US and do not generally put blast furnace sludge or turnings and borings into the sinter mix because of their high hydrocarbon content. The USSR has a full-scale SO_2 control system in operation at a sinter plant at Magnetogorsk.

The US is more advanced with one full-scale recycle system in operation and a second under construction. Older US plants employ multiclones followed by dry ESP for particulate control. These achieve outlet particulate concentrations of about 200 mg/nm^3. New plants are being constructed with high energy wet scrubbers in order to achieve sufficient control not only of particulates but also hydrocarbons. US EPA goals from recycle are to reduce the quantity of gas to be cleaned and to reduce the hydrocarbon concentration. US practice is towards high basicity (superflux) sinter.

Blast furnace sludge has been put into sinter for many years in the US. Another common US practice is the charging of turnings and borings to the top of the blast furnace. Oil from these turnings and borings is distilled and caught in the blast furnace flue dust. The flue dust and blast furnace sludge contain much of the oil that was in the turnings and borings. When this is charged to the sinter plant a hydrocarbon problem results.

2.2.3 Coke Making

The USSR produces about 80×10^6 metric tons of coke per year. They are concerned with emissions from all phases - charging, pushing, quenching and leakage - as in the US. The main approach for controlling charging emissions is similar to the EPA/AISI system with sequential charging. Pushing control systems are in the preliminary stages of development. They have done little to control emissions from wet quenching since this is being phased out in favor of dry quenching. There are now at least 40 dry quenching units under construction or in operation processing 15×10^6 metric tons per year. Among the advantages claimed are improved coke quality, reduced coke rate in the blast furnace, recovery of energy in the hot coke, and reduced emissions. Coke oven doors and standpipe cap leakages appear to be better controlled in the USSR than in the US.

The US has in full-scale operation a number of systems for controlling charging and pushing emissions. Control of coke oven door leakage is under study by both the industry and EPA.

2.2.4 Blast Furnaces

The Soviets have a number of large, modern, high top pressure (i.e., 5,000 m^3, 3.5 atm abs) furnaces. The Soviets often employ three stages of gas cleaning to achieve particulate concentrations in the range of 3 to 10 mg/nm^3 as is required

when using an expansion turbine. Expansion turbines are economically attractive in the USSR, in combination with high pressure furnaces, since the gases must be expanded anyway for distribution and use as a fuel in the plant. The expansion turbine allows the recovery of much of the energy required to compress the blast air. However, to achieve the low particulate concentration required, the Soviets have had to rely on wet cleaning methods, thus necessitating reheating of the gas ahead of the turbine. They are interested in developing dry cleaning so as to eliminate the reheat step.

The Soviets are developing slag desulfurization in combination with their practice of granulating at the blast furnace. The desulfurization project is now at the pilot plant stage. They are also developing controls for the cast house and for all hot metal reladling stations. The US is working on the development of controls for cast house emissions. Bethlehem's new 4000 m^3 furnace will employ a proprietary system marketed by Nippon. Bethelehem also has a building evacuation system in operation on a 700 m^3 blast furnace producing FeMn.

2.2.5 Steel Making Processes

Most of the USSR steel production is in open hearths. This is in contrast to the US where most open hearth shops have been phased out in favor of the Basic Oxygen Process (BOP). The Soviets are doing a fair amount of work in developing controls for the open hearth; however, this is of little interest to the US where considerable control of stack emissions is routine. The Soviets have started development of systems for controlling BOP charging and tapping emissions and in utilizing the fuel value of BOP off-gas. The US is working on controls for charging emissions (EPA project

with National Steel), and is ahead of the USSR in this area; however, the US has done little on utilizing the fuel value in BOP off-gas except to generate steam in a waste heat boiler above the furnace.

Both countries appear to be about equal in controls for electric arc furnaces; however, the USSR is interested in learning more about the direct vessel evacuation system employed in some US plants.

The Soviets have considerable experience with closed and semi-closed submerged arc ferroalloy furnaces whereas the US has only one semi-closed (and no closed) furnace in operation. The USSR is interested in systems for dry cleaning gases from closed furnaces.

2.2.6 Steel Rolling Processes

The USSR uses venturi scrubbers for control of scarfing emissions. They would like to switch to ESP's to reduce power consumption. US tried venturi scrubbers, was not satisfied, and is now using wet ESP's. It was agreed that the US would submit to the USSR data and information on the application of wet ESP's to scarfing emissions.

3.0 PROGRESS IN DEVELOPMENT OF COOPERATIVE PROGRAMS

3.1 Gaseous Emissions

3.1.1 General

Progress was made in most areas of existing cooperation. Confusion as to the Ryazan construction schedule was clarified. Firmer plans and time tables for continuing existing cooperation were made. The groundwork was laid for a possible US team of technologists to spend extended time at Severo-Donetsk. The USSR is interested in exchange of instrumentation. They are specifically interested in an arrangement to allow them to test a flow measurement device in the US. The device is patented so it may be assumed that they will try to market it here.

A return visit of US specialists to the USSR was proposed for the second quarter of 1975. A USSR specialists visit to the US was proposed for the fourth quarter of 1975.

3.1.2 Lime/Limestone Wet Scrubbing

Programs formulated previously were filled out with specific tasks and schedules. The primary data sources and organizations are Shawnee/EPA for the US and Magnetogorsk/NIIOGAZ for the USSR.

Some of the cooperative efforts were the physical/chemical phenomena of sulfite oxidation and the influence of additives on solubility and a USSR limestone reactivity measurement. Other efforts were testing additives at Shawnee and scrubbing equipment at Severo-Donetsk. Finally comprehensive

reports on Shawnee operating data, a TVA full-scale process design for Widows Creek #8, and the US status of solid waste disposal will be transmitted to the Soviets. Sampling and analytical chemistry procedures will be exchanged to facilitate data interpretation and improvement of techniques. US scientists are to visit the Magnetogorsk installation.

3.1.3 Magnesium Oxide Scrubbing

The cooperative effort focuses on US commercial size and USSR pilot scale efforts. Programs to give the Soviets general design and operating parameters were finalized. Most of this is to be completed in 1975.

The USSR is mainly contributing pilot scale data on equipment tests and basic physical/chemical data. Of particular interest to the US is their work in fluid bed drying and calcination. A mechanism was initiated to allow a team of US scientists to participate in data taking at the Severo-Donetsk facility.

US specialists will aid their Soviet counterparts in reviewing the USSR Ryazan design. The USSR final design and operating data for Ryazan will be transmitted to the US as it becomes available.

3.1.4 Ammonia Scrubbing

Ammonia scrubbing represents a lower cooperative effort primarily because of low US interest. Programs to provide US pilot plant data input to the USSR Ryazan design were arranged. The US will receive the USSR design and detailed operating data from the Ryazan plant after its start-up in approximately 1978.

3.2 Ferrous Metallurgy

3.2.1 General

The cooperative efforts initiated were continued. The information previously exchanged was discussed. An agreement about the dry quenching of coke that was made in Kharkov was overturned in Moscow by Licensintorg, a Soviet foreign trade group.

An exchange of visits was proposed for the third quarter of 1975. A visit of USSR specialists to the US was proposed (and did take place) for December, 1974.

3.2.2 Sintering Plants

Agreements were made to exchange information on reduction of dust emissions by gas recirculation and wet and dry particulate removal. US specialists may visit the Magnetogorsk facility as part of the sulfur dioxide control program.

3.2.3 Coke Making

Programs were initiated to exchange information for reducing emissions from coke ovens. Specific areas are means of charging and pushing, Larry car-free operation with pre-heated coal, and mechanical means of sealing the ovens. Dry quenching of coke has been an area of strong US interest but Soviet members of Licensintorg wished to place restrictions on the information that the US delegates considered undue. No agreement could be reached in this area.

3.2.4 Blast Furnaces

An information exchange program was initiated to lay the groundwork for several programs. The first is blast furnace top gas where the USSR has more experience in expander turbines for energy recovery. The US will present data to the USSR on cast house air pollution control. After studying this the Soviets will formulate their plans for a future cooperative effort. Finally, there will be an information exchange on how to reduce total effluents as well as emissions from blast furnaces.

3.2.5 Steel Making Processes

It was agreed to exchange information on the basic oxygen and electric furnaces as a first step to developing cooperative programs. The main area identified was reliable reduction of emissions during charging and tapping.

3.2.6 Steel Rolling

US experiences in the use of wet electrostatic precipitators to control emissions will be transmitted to the USSR. Future programs will be developed based on these data.

4.0 FACILITIES VISITED

Several organizations and physical facilities were visited. Since the teams were separated most of the time these will be listed separately.

4.1 Gaseous Emissions

Organizations (and Associated Laboratories):

State Research Institute of Industrial and Sanitary Gas Cleaning (NIIOGAZ), Moscow and Zaporozhye.

Institute for Design of Gas Cleaning Equipment (GIPROGAZOOCHISTKA), Moscow.

Plants:

Severo-Donetsk Power Plant, Pilot Plant Installation, Severo-Donetsk, Ukraine.

4.2 Ferrous Metallurgy

Organizations (and Associated Laboratories):

Power Services and Organizations Administration, Ministry of Iron and Steel Industry, Moscow.

Institute "VNIPICHERMETENERGOOCHISTKA", Karkov.

Plants:

Cherepovets Metallurgical Plant, Cherepovets.

SECTION 5.0 - PROTOCOLS

Section 5.1

Protocol of the I-st Working Meeting of the USSR/USA Task Force on Abatement of Air Pollution from Iron and Steel Industry Units

P R O T O C O L

of the I-st working meeting of the USSR/USA Task Force on abatement of air pollution from iron and steel industry units

According to the protocol of the 2-nd meeting of the USSR/USA Working Group on Stationary Source Air Pollution Abatement signed in Washington on April 25, 1974, in the USSR in November II to 22, 1974, the USSR and the USA experts have met to develop programs of cooperation in air pollution control from steel works.

The head of the USA Task Force was N.Plaks, the Chief of the Metallurgical Process Section, Control Systems Laboratory, EPA.

The USSR Task Force was headed by V.I.Petrikeyev, Head of Power Services, and Organizations Administration, Ministry of Iron and Steel Industry. The participants are listed in Appendix I.

After the 2-nd meeting of the Working Group in April 1974 information was exchanged on the research and development program of the US EPA for air pollution control in the iron and steel industry and a similar programm of the USSR Ministry of Iron and Steel industry.

At the meetings in Moscow, Kharkov, and Cherepovets information exchanged previously obtained was discussed as well as new Soviet and American research and development in air pollution abatement for main processes of steel works. Both sides agreed to principal directions and methods for further cooperation.

The US team was given an opportunity to become acquainted with installations equipped with air pollution control systems and organizations developing them.

The installations visited are listed in Appendix 2. The projects discussed during the meeting will be carried out in the near future according to schedules agreed upon and following the approval of the Working Group. The projects are as follow:

A-M1 Research and development of technology of air pollution control in sintering production.

A-M2 Research and development of technology for air pollution control in coke making.

A-M3 Research and development of technology for air pollution control of blast-furnace emissions.

A-M4 Research and development of technology for air pollution control in steel making processes.

A-M5 Research and development of technology for air pollution control in steel rolling processes.

B-m1 Dry quenching of coke

During the present meeting the Task Force failed to find a mutually acceptable way to evaluate the applicability of the dry quenching of coke technology to the US conditions.

Projects contained within this protocol are developed as a part of the activity of the Stationary Source Air Pollution Abatement Working Group and will be coordinated by the responsible subgroups.

Schedules in details are given in Appendix 3.

Alterations and additions to the protocol will be discussed at the next meetings of the USSR/USA ~~preliminary-team~~ Task Force.

Both sides noted that meetings were held in the spirit of friendship, mutual understanding and cooperation.

Protocol is signed on November, 21, 1974 in Moscow, in Russian and English, both texts are equally valid.

V.I.Petrikeyev
Head of delegation of the USSR, Head of Services and Organizations Administration, Ministry of Iron and Steel Industry of the USSR

N.Plaks
Head of delegation of the USA, Chief of Metallurgical Process Section of Control Systems Laboratory, NBS

Annex I

PARTICIPANTS OF THE I-ST WORKING MEETING OF THE USSR/US TASK FORCE

The USA

N.N. Plaks	Chief, Metallurgical Process Section, Control Systems Laboratory, EPA
R.C.McCrillis	Chief Project Officer, Metallurgical Process Section, Control Systems Laboratory, EPA
M.J. Stasikowski	Technical Assistant, EPA Headquarters, Air Pollution Control Division
H.C. Henschen	Manager of Engineering, Bethlehem Steel Corporation

The USSR

Petrikeyev V.I.	Head of power Services and Organizations administration, Ministry of Iron & Steel Industry of the USSR
Yegorichev A.P.	Chief Engineer of Power Services and Organizations Administration, Ministry of Iron & Steel Industry
Molchanov Yu.D.	Chief of Department of Power Services and Organizations Administration, Ministry of Iron & Steel Industry of the USSR
Tolochko A.I.	Director of Institute "VNIPICHERMETENERGOOCHISTKA"
Maksimov B.N.	Senior Engineer of Power Administration, Ministry of Iron & Steel Industry of the USSR
Talalaev G.K.	Chief of Main Departament for coke production of the Ministry for Iron and Steel of the USSR

Dello A.A. Chief of Foreign Relations Department of Power Administration, Ministry of Iron & Steel Industry of the USSR

Samofal S.V. Chief Engineer of Institute "VNIPICHERMETENERGOOCHISTKA"

Filipyev O.V. Deputy Director of Institute "VNIPICHERMETENERGOOCHISTKA"

Konovalov I.N. Chief Engineer of Cherepovets Metallurgical Plant

Ostrovskiy O.P. Chief of Technical Department, Institute "VNIPICHERMETENERGOOCHISTKA"

Zhylinskiy A.N. Chief of Department, Institute "VNIPICHERMETENERGOOCHISTKA"

Ilchenko A.V. Chief of Department, Institute "VNIPICHERMETENERGOOCHISTKA"

Lihogub E.P. Chief of Department, Institute Giprokoks

Teplitskiy M.G. Chief Power Engineer of Cherepovets Metallurgical Plant

Rovenskiy A.I. Head of Laboratory, Institute "VNIPICHERMETENERGOOCHISTKA"

Malinin B.N. Deputy Head of International Activities Administration, Ministry of Iron and Steel Industry

Churakov V.P. Senior Engineer, "Licensintorg"

Interpreters

Piotrovskiy V.V. Engineer of Institute "VNIPICHERMETENERGOOCHISTKA"

CHerevichenko G.V. Engineer of Institute "VNIPICHERMETENERGOOCHISTKA"

Appendix 2

November I2, 20, 2I

American delegation has visited the Ministry of Iron and Steel Industry of the USSR.

November I3, I4 and I5

American delegation has visited the Ministry of the Institute "VNIPICHERMETENERGOOCHISTKA", Kharkov.

November I8, I9

American delegation has visited Cherepovets iron and steel plant (city of Cherepovets) and got acquainted with:

I. Coke making - smokeless charging of coke oven batteries, dry coke quenching installation.

2. Blast furnace process - blast furnace No. 4, gas cleaning installation of the furnace with gas expansion turbines No. 8 and No. I2.

3. Rolling production - rolling mill "I700"

4. US experts have been given samples of coales, coal mix and coke of Cherepovets plant.

AM-1

RESEARCH AND DEVELOPMENT OF TECHNOLOGY FOR AIR POLLUTION CONTROL ON SINTER PRODUCTION UNITS

I. General

In the USA particulates are removed from sinter machine gas with cyclones and electrostatic precipitators. At the present time precipitators do not provide for increased requirements for removing the particulate matter due to increasing use of high basicity sinter and oil in the charge material[*]. The main and most widely used particulate collection process is scrubbing. (In USSR)

Sintering gases are not currently dessulfurized. A gas recirculation system is being developed and built in the USA to reduce particulate, SO_2 and hydrocarbon emissions. In the USSR the sintering gases are cleaned of particulate and SO_2 by scrubbing. The USSR is also interested in and is developing electrostatic precipitators and gas recirculation systems.

2. Objective

The objective is the mutual interchange of research, development results as well as operation data and specifications about sintering air pollution control techniques. The interchange is expected to result in the solution of problems common to the USSR and the USA, for air pollution from sintering and will result in development of optimal air pollution control technique.

3. Scope of work

To achieve the objectives the following projects should be undertaken:

---

[*] On using bag filters a mix of moisture, hydrocarbons and dust in the fumes blinds bags.

AMI-1

Nomination

I. Research and development of sintering machine operation with gas recirculation.

Objective:

Reducing of dust and gas emissions.

Cooperation forms:

I. The USSR/US task force will interchange available documents about pilot plants or full scale operation, as applicable, with sintering gas recirculation and which will include:

a) operational description of a plant with sintering gas recirculation

b) physical and chemical properties of dust and gas flows without recirculation

c) sizes and characteristics of main equipment items with materials used

Term - from the USA party - 3-rd quarter, 1975, from the USSR party - 4-th quarter, 1975.

d) effects of recirculation on sinter quality

e) effects of recirculation on sinter plant operation and economics.

g) physical and chemical properties of dust and gas flows with recirculation of sinter machine gas

Term - 3-rd quarter, 1976.

2. Both sides will meet to evaluate the results obtained and develop a program for future cooperation.

Term - according to mutual agreement.

3. During the visit of experts to both of the countries it would be desirable to see the sinter plant gas recirculation systems of both countries.

AM1-2

Nomination:

Development of technology for removal of SO_2 from sintering gases.

Objective:

Reducing of sulphur dioxide emissions.

Cooperation forms:

I. The task force of the USSR will submit to the US task force available reports on sulphur dioxide removal systems for sintering plants.

a) operational description of the unit

b) physical and chemical properties of dust and gas flows before and after the cleaning process.

c) sizes and characteristics of the main equipment including materials used.

Term - 2-nd quarter, 1975.

2. Experts of the USSR will give all necessary consultation to experts of the US for the development of similar installation. It is desirable for the US experts to visit a full-scale limestone facility at a sinter plant.

Term - 3-rd quarter, 1975.

3. The USSR and the USA Task Force will continue exchange of information, technical documentation concerning new developments on sulphur dioxide removal from sintering gases.

AM1-3

Nomination:

Improvement of plants for wet and dry cleaning of sintering gases.

Objective:

Improvement of performance of wet and dry sinter plant emission control devices.

Cooperation forms:

I. The US Task Force will submit to the USSR Task Force available information on the operation of sinter plants with electrostatic precipitators. The USSR Task Force will submit to the US Task Force information on sintor plants using Venturi. The following should be included:

a) description of the gas cleaning system

b) sizes and characteristics of equipment for the gas cleaning unit

c) physical and chemical properties of dust and gas emission before and after cleaning process.

d) conceptual design solutions and materials used.

Term - 2-nd quarter, 1975.

2. If it is determined that it would be desirable for the experts to meet, a meeting will be arranged during which the experts can see the sinter plant gas recerculation systems of either country.

Term - I-st visit of Soviet experts - December, 1974, American exports - 3-rd quarter, 1975.

AM 2

RESEARCH AND DEVELOPMENT OF AIR POLLUTION CONTROL TECHNOLOGY IN COKE MAKING

I. General

In both the USSR and in the USA coke is made in coke ovens of various design that emit particulate and harmful gases into the air.

Principal emissions are generated while charging the coke ovens, pushing and quenching the coke and from leakege of gases through poor seals of equipment.

For emissions while both charging and pushing, both in the USSR and the USA, studies are being carried out using various approaches such as smokeless charging without a larry car, and dust and gas collecting while pushing.

In the USSR a method of dry quenching is developed and is in wide industrial use to significantly reduce emissions while simultaneously recovering the sensible heat in the hot coke.

2. Objective

The both sides have expressed a wish to interchange information and experts to develop efficient means of reducing emissions from coke ovens.

3. Scope of work

To achieve the objective the following projects should be undertaken:

A. M2-1 Nomination

Improvement of technology for smokeless oven charging and dust-free coke pushing.

Objective

Dust and gas emissions reduction.

Cooperation forms

The USSR and the US will interchange available information on the applicability of the technology for smokeless oven charging and emission-free coke pushing. The information will include:

a) description of methods being applied

b) conceptual design solutions and general information on materials used

c) general specifications of the equipment

d) efficiency of plants operation

Term - IV quarter, 1975

A -M2-2 Nomination

Larry car-free charging of ovens with preheated coal.

Objective

Elimination of gas emissions into the atmosphere.

Cooperation forms

The US will assist the USSR in acquiring available information on the coke oven operation with larry car-free charging with preheated coal. Information will include:

a) conceptual solutions and materials used

b) parameters and flow rate of the transporting agent per ton of coal

c) productivity per hour and charging rate

d) reliability of equipment operation.

Term - 2-nd quarter, 1975.

BM2 Nomination

Dry coke quenching.

Objective

Reduction of objectionable emissions to the atmosphere, coke quality improvement and utilization of the heat in the coke.

Cooperation Forms

I. The USSR and US will exchange proposal on how to evaluate the benefits of dry coke quenching when the process is applied to American type coals and data confirming this applicability.

Term I quarter, 1975

If the proposals are satisfactory, during the subsequent visit of USSR experts to the USSR, the proposals and data will be discussed and a program of cooperation will be developed.

Term 3 quarter, 1975.

A-M 2-3 Nomination

Sealing of coke oven doors, stand pipe caps, charging hole lids and levelling bar door.

Objective

Reduce emission of gases and particulates.

Cooperation forms

I. The USSR and the USA will interchange available information on design and methods of operation of coke oven doors, riser caps, charging, and levelling holes. Included will be:

a) conceptual design and materials used

b) methods of maintenance and routine repairs

c) service life of lining of coke oven doors and charging holes

Term - II quarter, 1975.

2. The USSR and the USA will interchange experts to visit works and to study operational practice.

Term - III quarter, 1975.

A -M24Nomination

Improvement of continuous coke making technology for metallurgical coke production.

Objective

Dust and gas emissions reduction.

Cooperation forms

The USSR and the US will interchange available information on the technology for continuous production of metallurgical coke

a) description of methods being applied

b) conceptual design and general information on materials used

c) general specifications of the equipment

d) results in blast furnace

e) results in reducing pollution.

Term - III quarter, 1975.

A-M3 RESEARCH AND DEVELOPMENT OF TECHNOLOGY FOR AIR POLLUTION CONTROL OF BLAST FURNACE EMISSIONS

I. General

In both the US and in the USSR identical systems are used for blast furnace gas cleaning. To prevent air pollution from the cast houses work is being carried out in the US and in the USSR. As an example, for the cast house of a 4000 m^3 blast furnace, one company has designed and is erecting a system for air pollution control under license of Nippon Steel (Japan).

In the USSR there are under operation systems for utilizing the top gas pressure of blast furnace gas for power production, also used are systems for reducing emissions from charging the blast furnace.

2. Objective

The objective is the interchange of information on research, development, operation, and specifications on emission control and utilization of blast furnace excess pressure.

3. Scope of work

To achieve the objectives THE following should be carried out.

A-M3-1 Nomination:

Utilization of top gas pressure of the blast furnace, as a source of non-polluting energy.

Objective:

Reduction of hot metal cost and indirect reduction of atmospher: pollution.

Cooperation forms:

The USSR will submit to the US available information on the systems for excess pressure utilization of the blast furnace top gas, including:

a) operational description of the expansion turbine

b) characteristics of the main equipment

c) physical and chemical properties of the gas flow before and after the turbine

d) operational parameters of the unit

e) economic benefits of the system

Term - 2-nd quarter, 1975.

A-M3-2 Nominations:

Development and research of collection and gas cleaning systems for cast house emissions.

Objective:

Reducing of air pollution from cast houses.

Cooperation forms:

I. The US will submit to the USSR available information on the installations for air pollution control from cast houses on blast furnaces under construction.

Following items should be included:

a) conceptual design of the emission reduction installation

b) physical and chemical properties of the dust laden gas streams

c) sizes and characteristics of equipment, enclosures and materials used

d) report on any test data available

Term - 3-rd quarter, 1975.

2. Having studied information submitted by the US the USSR will present its plans for future cooperative program.

Term - I-st quarter, 1976.

3. Experts of both countries will meet to discuss and plan the program of cooperation.

Term - according to mutual agreement.

Nomination:

A-M3-3 Development of technology for reduction or cleaning emissions from blast furnace charging systems.

Objective

Reduction of dust and gaseous emissions.

Cooperation forms:

The USSR will submit to the US information on the technology for reduction or controlling emissions from the blast furnace charging systems. The following items should be included:

a) conceptual design data

b) physical and chemical characteristics of dust laden gas stream

c) sizes and characteristics of major equipment

d) report on any test data available

Term - 4-th quarter, 1975.

2. Having studied information submitted by the USSR the US will submit its plans for future cooperation.

Term - I-st quarter, 1976.

3. Experts of both countries will meet to discuss and develop the program for future cooperation.

Term - according to mutual agreement.

A -[illegible] RESEARCH AND DEVELOPMENT OF AIR POLLUTION CONTROL TECHNOLOGY FOR STEEL MAKING PROCESSES

I. General

In both the USSR and the USA hoods and systems for controlling basic oxygen furnace and electric furnace emissions are of similar design.

At present in the USSR and the US there is no reliable method for efficiently collecting emissions while charging and tapping basic oxygen furnace.

The study is being carried out in both the US and in the USSR to solve this complex problem.

2. Objective

~~The~~ Both sides have expressed a wish to cooperate in developing the technique and to interchange information to develop optimal methods for control of emissions.

3. Scope of work

To achieve the objective the following projects should be undertaken:

A -[illegible]Nomination

Research and development of air pollution control for charging and topping basic oxygen furnace.

2. Objective - is to reduce dust and gas emissions.

3. Cooperation forms

I. The USA and the USSR will interchange documents and reports on research carried on pilot and industry systems for collecting gases while charging and tapping basic oxygen furnace . The information should include:

a) operational description of the emissions collecting systems

b) physical and chemical properties of dust laden gas stream

c) dimensions and specifications of enclosures and materials used general

d) influence of collecting system on economics and operation of the basic oxygen furnace.

Term: The US will submit the information to the USSR in III quarter of 1975

The USSR will submit the information to the USA in IV quarter of 1975

2. Having received information both sides will meet to evaluate the results and to develop a program for further cooperation.

Term - on mutual agreement .

AM-5 RESEARCH AND DEVELOPMENT FOR AIR POLLUTION CONTROL TECHNOLOGY FOR STEEL ROLLING PROCESSES

I. General

In the US wet electrostatic precipitators are used for controlling scarfing emissions.

The USSR is interested in receiving information on this method of gas cleaning.

The both sides will cooperate if some new problems appear.

A-M5-1 Nomination

Emission control while scarfing of steel.

Objective is to control emissions from the scarfing of steel.

Cooperation forms

I. The US will submit to the USSR information about the systems for controlling emissions while scarfing which will include:

a) operational description of the system

b) physical and chemical properties of gases before and after cleaning

c) design, dimensions and specifications of the major equipment (wet electrostatic precipitators) and materials used

d) influence of the cleaning system on technical and economic factors of a rolling mill operation

e) long-term operation results.

Term - II quarter, 1975.

The US experts will give the consultation required to the USSR experts if similar systems are developed in the USSR.

Term - on a request of the USSR study team.

3. It is desirable to include into the program of the first visit of Soviet experts to the US the acquiantance with the system for emissions control, after steel scarfing, using wet electrostatic precipitators.

Term - December, 1974.

FINAL VISIT IN 1974

The Task Force approves a visit of the Soviet side experts to the USA in December, 1974 in accordance with Protocol of April 25, 1974, when acquaintance will be made with as many as possible of the following units:

a) a system for cleaning sintering gases in electrostatic precipitators

b) a sintering fumes recirculation system

c) blast furnace casting houses emissions control

d) a system for capturing and cleaning emissions generated while charging and tapping basic oxygen furnace

e) the means for capturing and cleaning of electric furnace gases in bag filters

f) systems for capturing and cleaning scarfing fumes in wet electrical precipitators.

1975 VISITS

The Task Force agreed that the US experts visit the USSR to become acquainted with USSR iron and Steel making processes in the III quarter, 1975, and a visit to the US of the Soviet experts to become acquainted with US iron and steel making Processes in the III quarter, 1975.

Section 5.2

Protocol of the Second Working Meeting of the US/USSR Sulphur Oxides Technology Sub-Group

PROTOCOL

of the second working meeting of the US/USSR

Sulphur Oxides Technology Sub-Group

In accordance with the Memorandum of the second session of the US/USSR committee on cooperation in the field of environmental protection (the USA, Washington, November 13 - 16, 1973) and the Protocol of the second meeting of the US/USSR Technology Working Group, the second meeting of the US/USSR Sulphur Oxides Technology Sub-Group was held in the USSR during November 11-22, 1974.

The US Sub-Group was headed by Mr.Michael A.Maxwell, Project Director, Control Systems Laboratory, Environmental Protection Agency.

The Soviet Sub-Group was headed by Mr.Vladimir I.Lazarev, Deputy Director, State Research Institute of Industrial and Sanitary Gas Cleaning. A list of Participants is attached as Appendix 1.

At the opening session, the agenda and itinerary for the balance of the meeting were reviewed. Both sides reviewed the status of tasks agreed to at the First Working Meeting of the Sub-Group. Both sides agreed to prepare a detailed working program, defining the scope and schedule of all tasks mentioned in the Protocol of the First Meeting (Appendix 2).

Both sides agreed that the further work on tasks N°5,6,7 (subject A-1), 2,3,4,5,6,7 (subject A-2), 3,4,5,6,7 (subject A-3) should be carried out in accordance with the program.

Moreover, it was pointed out during the meeting that the work concerning the tasks 2,4 (subject A-1), 4 (subject A-2),

2 (subject A-3) had been completed.

The Soviet side transmitted to the US side the reports on research and design work for the limestone cleaning method (task 2, subject A-1).

The US specialists were provided with the opportunity to visit and to familiarize themselves with the operation of the power flue gas desulphurization unit (magnesia method) in Severo-Donetsk. They were also informed about construction and process parameters of this unit under task 4, subject A-1 ; task 1, subject A-2. The visit to Magnitogorsk under task 9 could not be arranged.

In addition the American side visited the NIIOGAS branch in Zaporozhye and was provided an opportunity to learn about on-going research work in that Institute.

A visit to the limestone flue gas desulphurization plant in Magnitogorsk is scheduled during the next meeting of the Sulphur Oxides Technology Sub-Group in the USSR.

The design of the unit in Ryazan was discussed at GIPROGAZOOCHISTKA.

Both sides agree to continue the mutual exchange of information relevant to both (1) the cooperative program developed and (2) emerging technology in the sulphur dioxide control field.

In continuing the expanding cooperation, both the US and USSR Sulphur Oxides Technical Sub-Group agreed to request the Working Group to consider increasing personnel allocations. Two types of personnel exchange should be considered. The first type would include specialists for continued coordination and direction of the cooperative exchange program. The second

type would be technical personnel to actually carry out certain provisions of the cooperative research programs outlined in A-1, A-2 and A-3. These personnel (technical research teams) could be assigned to participate in active on-going programs at Shawnee, Severo-Donetsk and Magnitogorsk.

The American side agreed also to survey the possibility of exchanging instrumentation for use on the pilot plants at Shawnee and Severo-Donetsk.

The USSR will provide information on instrumentation and process control systems for sulphur dioxide removal installations so that the US side can consider the question of exploring cooperation in this field at the next meeting of the Sulphur Oxides Technology Sub-Group.

Schedule: January - February, 1975.

The information submitted to the Soviet side by the US side is listed in Appendix -3.

Both sides noted that the meeting had been mutually productive and had been conducted in a spirit of friendship, united understanding and cooperation.

The present Protocol was signed in Moscow on November 21st, 1974 in two copies - in English and in Russian, both copies equally authentic.

VLADIMIR I.LAZAREV

Head of the Soviet Team of the US/USSR working subgroup on industrial source SO_2 emission control technology

MICHAEL A. MAXWELL

Head of the American Team of the US/USSR working subgroup on industrial source SO_2 emission control technology

1. Delegates to the Second Sub-Group Working Meeting

USA

Michael A. Maxwell
Project Director
Control Systems Laboratory
Environmental Protection Agency
Research Triangle Park, North Carolina

William H. Elder
Director
Stack Gas Emissions Studies Staff
Tennessee Valley Authority
Muscle Shoals, Alabama

Phillip Lowell
Principal Scientist
Radian Corporation
Austin, Texas

G.R. Koehler
Project Director, Process Department
Chemico,
New York, New York

Robert W. Crozier
Executive Secretary,
Committees on Pollution Abatement
and Control National Research Council,
Washington

USSR

Vladimir I.Lazarev
Deputy Director for Scientific Work
State Research Institute of Industrial
& Sanitary Gas Cleaning (NIIOGAZ),
Moscow

Directpr of State Research Institute
of Industrial and Sanitary Gas Cleaning (NIIOGAZ),
Ministry of Chemical & Petroleum Machine Building,
Moscow

Ildus K. Reshidov
Director of Institute for Design of Gas
Cleaning Equipment (GIPROGAZOOCHISTKA),
Ministry of Chemical & Petroleum Machine Building,
Moscow

Aleksey P. Andrianov
Chief Engineer
Institute for Design of Gas Cleaning Equipment
(GIPROGAZOOCHISTKA)
Ministry of Chemical & Petroleum Machine Building,
Moscow

Valery Ja. Mosharov
Chief Design Engineer
Institute for Design of Gas Cleaning Equipment
(GIPROGAZOOCHISTKA)
Ministry of Chemical & Petroleum Machine Building,
Moscow

Vitaly I. Budanov
Chief of pilot installation,
Severo-Donetsk power plant,
Severo - Donetsk

2. Participants in the Second Sub-Group Working Meeting

USA

Harrington, R.E. - Director, Air Pollution Control Division, EPA

Stasikowski, M. - Technical Assistant
Air Pollution Control Division
Environmental Protection Agency
Washingon, D.C.

USSR

Anikeev, V.A. - Chief, All Union Gazoochistka Combine, Moscow, NIIOGAZ

Gladky, A.V. - Master of Technical Sciences
laboratory head, NIIOGAZ
Moscow

Brodsky, Y.N. - Master of Technical Sciences
Scientific and Economic Research
Branch Chief, NIIOGAZ
Moscow

Shkatov, E.F. - Master of Technical Sciences
Laboratory head, NIIOGAZ,
Moscow

Rulnov, A.A. - Master of Technical Sciences,
Laboratory head, NIIOGAZ,
Moscow

Efimov, B.L. - Master of Technical Sciences,
International Relations Section
Chief, NIIOGAZ,
Moscow

Shumarova, L.E. - International Relations Group
Supervisor, NIIOGAZ,
Moscow

Shucin, B.I. - Department head,
GIPROGAZOOCHISTKA,
Moscow

Ginzberg, S.A. - Chief Technologist,
GIPROGAZOOCHISTKA,
Moscow

Abakumova,L.N. - Chief Design Engineer,
GIPROGAZOOCHISTKA,
Moscow

Aliev, G.M.A. - Chief of Coordination Department,
GIPROGAZOOCHISTKA,
Moscow

Philippova,N.V.- Group Supervisor of Technical
Department,
All Union GAZOOCISTKA combine,
Moscow

Krayushkina,T.I.- Group Supervisor,
GIPROCHIM,
Moscow

Nechvolodov,A.A.- Group Supervisor,
Research Institute of Fertilizers
& Fungicides,
Moscow

Rudenko, S.P. - Director of Severo-Donetsk
Power Plant "Donbusenergo",
Severo-Donetsk

Crol, V.F. - Vice-Director of Severo-Donetsk
Power Plant "Donbusenergo",
Severo-Donetsk

Selishev,A.P. - Vice-Director of Severo-Donetsk
Power Plant " Donbusenergo "
Severo-Donetsk

Zaporozhyye, - pilot sulfur recovering installation of Svero-Donetsk Power Plant "Donbusenergo", Severo-Donetsk

Kravchenko, A.D. - Chief of Chemical Service, "Donbusenergo", Severo-Donetsk

Boev, I.Ja. - Director, State Research Institute of Industrial and Sanitary Gas Cleaning, Zaporozhyesky Branch, Zaporozhye

Alekseev, N.I. - Deputy Director for Scientific Work, State Research Institute of Industrial and Sanitary Gas Cleaning, Zaporozhyesky Branch, Zaporozhye

Znamensky, L.D. - Deputy Director for Scientific Work, State Research Institute of Industrial and Sanitary Gas Cleaning, Zaporozhyesky Branch, Zaporozhye

Pavlik, Y. S. - Laboratory Chief, State Research Institute of Industrial and Sanitary Gas Cleaning, Zaporozhyesky Branch, Zaporozhye

Prihodko, V.P. - Chief, Spray-catcher process Section, State Research Institute of Industrial and Sanitary Gas Cleaning, Zaporozhyesky Branch, Zaporozhye

Repin, M.D. - Scientific-Technical Department Chief, State Research Institute of Industrial and Sanitary Gas Cleaning, Zaporozhyesky Branch, Zaporozhye

3. Interpretor

Utkin, N.I. - Scientific-Technical Department, Academy of Sciences, USSR

A-1. Development of limestone scrubbing process for flue gas desulfurization.

U.S. Cooperative programm.

Task 1.

The Shawnee pilot installation will be used to determine the effect of different technological parameters (pH and composition of scrubbing slurry gas velocity, liquid rate,etc) on efficiency of SO_2 removal and limestone utilization. The report of results will also include data on system reliability schedule: 1975 as reports are completed. Reports on system reliability testing and a detailed description of plans for future work will be transmitted during the second quarter, 1975.

Task 2.

The US specialists will provide documentation descibing test methods and analytical procedures used in the Shawnee test program.

Schedule: 1st quarter 1975.

Task 3.

An experimental study of benzoic acid addition to improve utilization of limestone will be made at Shawnee. A report will be provided containing kinetics data for SO_2 absorption as a function of gas velocity, liquid rate, and benzoic acid concentration. Equilibrium data in system SO_2-$CaCO_3$-H_2O -benzoic acid for the temperature range 20-60°C will be included.

Schedule: 4th quarter, 1975.

Task 4.

An experimental study to determine the effect of magnesium salt addition on SO_2 absorption efficiency will be made at Shawnee. It will include the influence of magnesium salt concentration, effect of gas velocity and liquid rate upon SO_2 absorption kinetics A study of equilibrium data in the presence of magnesium salts for the temperature range 20-60°C will be included.

Schedule: 4th quarter 1975.

Task 5.

The US specialists will provide reports describing the status of technology for disposing or utilizing solid wastes from lime/limestone scrubbing processes.

Schedule: 2nd quarter, 1975.

Task 6.

The US will provide a finalized flowsheet and material balance for the Widows Creek Power Station unit 8.

Schedule: 4th quarter, 1974.

Significant equipment dimensions and materials of construction will be provided as well.

Schedule: 3nd quarter 1975.

Task 7.

A visit of US SO_2 specialists to the USSR will be made for coordination and discussion of results of the cooperative program.

Schedule: late 2nd quarter, 1975.

From the Soviet side.

Task 1.

Chevron and centrifugal type mist eliminator will be tested at the Severo-Donetsk pilot plant to select the optimum type and the optimum conditions for the best type of mist eliminator. These studies will be made while the pilot unit is operated with magnesium oxide. The mist eliminator selected will then be tested with limestone.

The USSR will furnish a test plan for mist eliminator testing at the Severo-Donetsk pilot plant. The test plan will describe the type of tests and schedule for the tests.

Schedule - Test Plan - 1st quarter of 1975.

Reports of Tests - 4th quarter of 1975.

Task 2.

The USSR will study the kinetics of SO_2 absorption by limestone scrubbing at the Severo-Donetsk pilot plant using two types of high velocity absorbers.

(1) pebble bed

(2) spray tower

Submittal of test results

Report-schedule - 4th quarter 1975.

The planned test program will be submitted - schedule 1st quarter 1975.

Task 3.

The USSR will study the kinetics of calcium sulfite oxidation in the presence of liquid-phase catalysts for the purpose of increasing the absorption efficiency and improving properties of the solid waste materials produced.

This will include application of Co,Fe and Cu salts and

and sulfur containing dyes as catalysts to obtain a gypsum product (decorative for dyes).

Submittal of report. Schedule - 4th quarter 1975.

Task 4.

The USSR will develop procedures for estimating reactivity of different limestones.

Transmittal of report. Schedule - 4th quarter, 1975.

Task 5.

The USSR will provide a report describing in detail the test methods and analytical procedures which are used in the limestone scrubbing process in NIIOGAZ laboratories and the Severo-Donetsk pilot plant.

Schedule: 1st quarter 1975.

Task 6.

The USSR will provide a report making a comparison of predicted versus experimentally determined $CaSO_3$ oxidation rates using laboratory and Magnitogorsk data.

Schedule: 3rd quarter 1975.

Task 7.

A visit of USSR SO_2 specialists to the U.S. will be made for coordination and discussion of results of the cooperative program.

Schedule: 4th quarter 1975.

A - 2. Lower SO2 flue gas desulfurization using magnesia scrubbing.

U.S. cooperative program.

Task 1.

To the extent that data is made available to EPA for public disclosure, the U.S. will provide design, operating and economic data from the PEPCO and Philadelphia Electric Magnesia Scrubbing installations.

Schedule: as it becomes available.

Task 2.

The USSR and USA will provide reports describing their respective test methods and analytical procedures for the magnesia scrubbing process at Boston Edison

Schedule: 1st quarter 1975.

Task 3.

The U.S. will provide the final report from the EPA /Boston Edison/ Chemico magnesia scrubbing process.

Schedule: 1st quarter 1975.

Task 4.

The U.S. will provide a report describing detailed cost estimates (including operating and investment Costs) for five advanced flue gas desulphurization processes.

Schedule: 1st quarter 1975.

Task 5.

The U.S. will undertake an economic comparison of different methods of settling/removing the $MgSO_3 \cdot 3H_2O$ crystals using the settling data received from the USSR. (Subject to

availability of funds).

Schedule: 4th quarter, 1975.

Task 6.

Visit of U.S. specialists to the USSR for coordination and discussion of results of cooperative programs.

Schedule: end of 2nd quarter 1975.

On the Soviet side

Task 1

The USSR will undertake development of a method of settling $MgSO_3 \cdot 3 H_2O$ crystals using polyacrylamide as a flocculant.

Transmittal of a report.

Schedule: 3rd quarter, 1975.

Task 2.

The USSR will provide a report describing the fluid bed drying and calcining of $MgSO_3$ done at Magnitogorsk.

Schedule: 4th quarter, 1974.

Task 3.

The USSR will provide a report describing the fluid bed drying/calcining of $MgSO_3$ to be conducted in Voskresensk.

Schedule: 4th quarter , 1975.

Task 4.

The USSR will conduct a study of the kinetics of recrystallizing $MgSO_3 \cdot 3 H_2O$ to $MgSO_3 \cdot 6 H_2O$ and $MgSO_3 \cdot 6H_2O$ to $MgSO_3 \cdot 3H_2O$.

This will include effects of temperature, pH, and solut-

Transmittal of report: 4th quarter, 1975.

The USSR will conduct a study of the kinetics of $MgSO_3$ oxidation in the presence of liquid phase oxidation inhibitors and catalysts. The effect of solution composition, temperature and $MgSO_3$ and $MgSO_4$ concentration will be studied.

Transmittal of report - 4th quarter, 1975.

Task 6.

The USSR will make an economic comparison of the four types of high velocity absorbers being investigated in Severo-Donetsk in order to select the optimum from the following:

(1) pebble bed

(2) ventury tube

(3) spray absorber

(4) APT

Transmittal of reports.

Schedule : 4th quarter, 1975.

Task 7.

The USSR will develop procedures for estimating relative reactivity of new and regenerated MgO.

Transmittal of report.

Schedule: 4th quarter, 1975.

Task 8.

The USSR will provide documentation describing test methods and analytical procedures, used in the magnesia scrubbing process.

Transmittal of report.

Schedule: 1st quarter, 1975.

Task 9.

The USSR will provide reports on the magnesia scrubbing pilot work underway at Severo-Donetsk:

(A) Study of efficiency of Venturi absorber when operated with high enthalpy gas (simulation of gas from boilers fired with heavy oil).

Transmittal of report.

Schedule: 1st quarter, 1975.

(B) Study of efficiency of Venturi absorber when operated with low enthalpy gas (gas from coal fired boiler).

Transmittal of report.

Schedule: 4th quarter 1975.

Task 10.

The USSR will provide project design data for the Ryazan magnesia scrubbing/regeneration system.

Schedule: 4th quarter, 1975.

Operating data will also be provided after system start up.

Schedule: to be determined during the course of construction.

Task 11.

Visit of USSR specialists to the U.S. for coordination and discussion of results of cooperative programs

Schedule: 4th quarter, 1975.

Task 12.

The USSR will provide information describing their laboratory studies of the reduction of $MgSO_3$ to elemental sulfur in

Schedule: 4th quarter, 1975.

A-3. Development of Ammonia Scrubbing for Stack Gas Desulphurization.

Cooperative Program in the U.S.

Task 1.

The US side will study the ammonium bisulfate scrubbing process including thermal decomposition of ammonium sulfate. A report of process equipment tests and evaluation of optimum operating conditions will be transmitted to the USSR.

Schedule: 4th quarter, 1975.

Task 2.

The US will study alternative regeneration methods in the Colbert pilot plant program to determine the feasibility of different methods used separately or in combination.

Schedule: indefinite subject to availability of funds.

Task 3.

The US will provide a report of analytical and test methods used at the ammonia scrubbing pilot plant at Colbert.

Schedule: 2nd quarter, 1975.

Task 4.

The US side will review the operating results from the Ryazan plant and suggest changes to improve the operation. Also, the US side will supply any further data developed in pilot plants or prototype installations in the U.S.A.

Schedule: to be determined as operating data becomes available.

Task 5.

The US delegation will visit USSR for coordination of the cooperative projects on ammonia scrubbing.

Schedule: end of the 2nd quarter, 1975.

On the Soviet side:

Task 1.

The USSR will perform laboratory studies of ammonium sulfite oxidation. Both catalysts and inhibitors will be tested. A report of the studies will be transmitted to the U.S.A.

Schedule: 4th quarter, 1975.

Task 2.

The USSR will provide revised flowsheet and material balance drawings for the Ryasan NH_3 scrubbing system.

Schedule: 2nd quarter, 1975.

Also, significant equipment dimensions and materials of construction will be reported when detailed design has been carried out to the point that this information is available.

Schedule: 2nd quarter, 1976.

Task 3.

The USSR side will supply detailed operating data from the Ryasan plant for review by the U.S.

Schedule: when operating data is available.

Task 4.

The USSR side will provide documentation of analytical methods and test procedures for ammonium scrubbing process.

Schedule: 2nd quarter, 1975.

Task 5.

The USSR side will visit the U.S. for discussion of the final project design of the Ryazan plant based on information to be transmitted by the USSR side during the 2nd quarter, 1975. Also, the ammonia scrubbing information transmitted during the 2nd quarter by the US side will be discussed as well as other areas of cooperation on ammonia scrubbing technology.

Schedule: 4th quarter, 1975.

The US side transmitted to the Soviet side the following information :

(A) design and operating specifications for fans and rubber lined pumps

(B) report describing status of flue gas desulfurization systems in the United States

(C) report describing limestone & lime test results at EPA alkali scrubbing test facility at TVA Shawnee power plant

(D) report-laboratory procedures - limestone wet scrubbing project Shawnee steam plant

(E) paper - progress in supplying environmental requirements.